GIANT DIPOLE RESONANCE AND JACOBI TRANSITION LEADING TO HYPERDEFORMATION

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The Giant Dipole Resonance (GDR) studies have been proved to be a powerful tool to study hot and rotating nuclei and recently the domain of GDR spreads rapidly over different areas of theoretical and experimental interest. In a macroscopic approach to GDR, the observables are related to the nuclear free energy surface with consideration of thermal shape fluctuations. We have revisited this formalism with more exact methods. The Nilsson-Strutinsky (NS) method extended to high spin and temperature is used for free energy calculations. Shell effects causing the quantal fluctuations are treated with exact temperature and spin dependence. The GDR built on the states determined by NS method are studied with a macroscopic model comprising anisotropic harmonic oscillator potential with separable dipole-dipole interaction [1]. Thermal fluctuations are dealt without any parameter fitting, in an exact way by calculating the free energies at the mesh points using the NS method. We have carried out a systematic study of the GDR properties in several nuclei and our results are well in conformity with experimental results. The Landau theory [2] results are found to deviate from exact calculations in the presence of strong shell effects (See Fig. 1). Shell effects which appear at higher spins could be taken care only in the exact fluctuation calculations (See Fig. 1(b)). With our present calculations, we have identified the zirconium region as a very fertile region to detect Jacobi transition which at lower temperatures leads to hyperdeformation. Even though the Jacobi transition survives higher temperatures we found that it may not lead to hyperdeformation.

[1] G. Shanmugam and M. Thiagasundaram, Phys. Rev. C **39**, 1623 (1989).
[2] Y. Alhassid, Nucl. Phys. **A649**, 107c (1999); and references therein.
[3] T. Baumann *et al.*, Nucl. Phys. **A635**, 428 (1998).

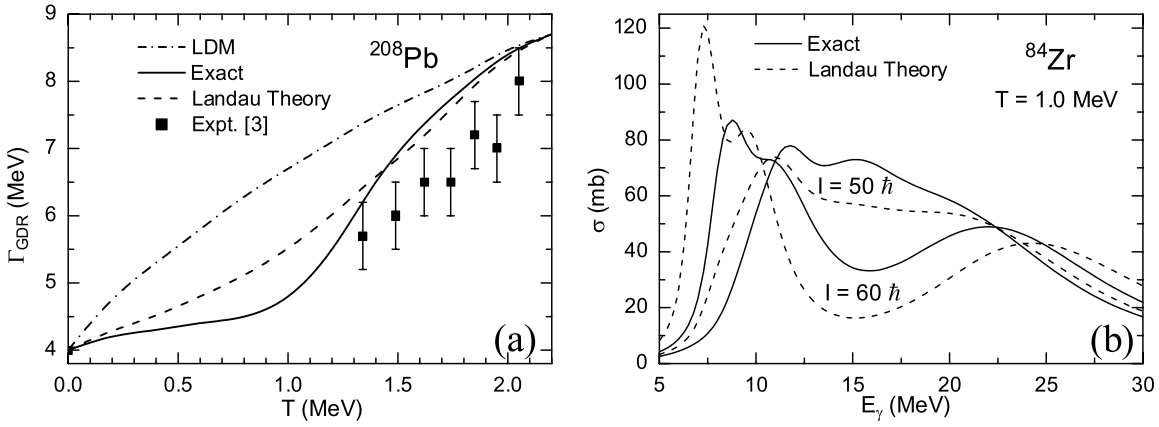

Figure 1: Comparison of GDR observables obtained using the Landau theory and exact method.